ADAPTATION OF METHODOLOGY CALCULATION RELATIVE CROWDING COEFFICIENT FOR EVALUATION COMPETITION OF TREE SPECIES IN POLYCULTURE

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Nowadays such indices as land equivalent ratio (LER), relative crowding coefficient (K), competitive ratio (CR), aggressivity (A), actual yield loss (AYL), and system productivity index (SPI) have been applied to describe competition and economic advantages in the intercropping. Our research is focused on the relative crowding coefficient, its adaptation to our results and attempt to resolve methodical controversial questions.

Relative crowding coefficient is a measure of the relative dominance of one species over the other in a polyculture (de Wit, 1960). Hall (1974) to assess the index of species comparative productivity for compatible species existence in community and named it as competitive power coefficient. Relative crowding coefficient is calculated as the following:

$$K_{ab} = \frac{Y_{ab} \cdot Z_{ba}}{(Y_{aa} - Y_{ab}) \cdot Z_{ab}} \quad (1) \qquad \text{and} \qquad K_{ba} = \frac{Y_{ba} \cdot Z_{ab}}{(Y_{bb} - Y_{ba}) \cdot Z_{ba}} \quad (2)$$

Where K_{ab} – the relative crowding coefficient for species ***a*** in polyculture with species ***b***;
K_{ba} – the relative crowding coefficient for species ***b*** in polyculture with species ***a***;
Y_{aa} – yield of species ***a*** in monoculture;
Y_{ab} – yield of species ***a*** in polyculture with species ***b***;
Y_{bb} – yield of species ***b*** in monoculture;
Y_{ba} – yield of species ***b*** in polyculture with species ***a***;
Z_{ab} – ratio (%) of species ***a*** to species ***b*** in polyculture;
Z_{ba} – ratio (%) of species ***b*** to species ***a*** in polyculture.

According to Willey (1979) both species has their own relative crowding coefficient within the intercropping system. Higher level of K_{ab} shows the predomination of species ***a*** over the other species with lower relative crowding coefficient. The product of K_{ab} and K_{ba} ($K=K_{ab}{\cdot}K_{ba}$) is interpreted as follows:

- if K is greater than 1, there is a yield advantage,
- if K is equals to 1, there is no yield advantage,
- if K is less than 1, there is a yield disadvantage.

Our research regards to influence of simulated acid rain and increased temperature on tree species of Bukovina in artificial models of ecosystems – microcosms. The question whether the multiple crops are more productive than single ones remains open and controversial. This problem is due to the fact that some species are growing better at the polyculture while other – at the monoculture. From the prospective of ecological crisis influence this situation can varied.

K_{ab} is highly applied to the grass species and it is used only with the positive sign in the current literature. This measure has not been applied previously to the tree species. Our application this measure to the tree species shows K_{ab} to be negative when productivity of species ***a*** within the multiple crops is higher than its productivity within the single crops. The negative value of K_{ab} indicates strong competitiveness of species ***a*,** while the positive value demonstrates its weak competitiveness in a polyculture. This means that sign of K_{ab} shows the strength of the studied species. Our results show the value of K_{ab} to be sensitive to the difference in species productivity within the monoculture and polyculture. Table 1 illustrates all possible varieties of K_{ab} values for both, ***a*** and ***b*** species.

Table 1 – Possible varieties of relative crowding coefficient values of species a and b in polyculture, and its explanation

Species *a*	**Species *b***	**Description**
$+K_{ab}$ $(K_{ab} > K_{ba})$	$+K_{ba}$	Both species exhibit weak inter-specific competitiveness, but species ***a*** is stronger than species ***b***
$-K_{ab}$ $(K_{ab} > K_{ba})$	$-K_{ba}$	Both species exhibit strong inter-specific competitiveness, but species ***b*** is stronger than species ***a***
$+K_{ab}$	$-K_{ba}$	Species ***a*** exhibit weak inter-specific competitiveness, species ***b*** is competitive strong in inter-specific interactions
$K_{ab}=0$	$K_{ba}=0$	Both species do not affect each other
$K_{ab}=0$	$+K_{ba}$	Species ***a*** does not affect species ***b***, within the last one exhibits weak inter-specific competitiveness
$K_{ab}=0$	$-K_{ba}$	Species ***a*** does not affect species ***b***, within the last one exhibits strong inter-specific competitiveness

Thereby, current methodology makes relative crowding coefficient to be a powerful tool for assessing of the competitive species interactions and for the estimation of economic advantages at the tree species polycultures.

References:

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